

WHAT IS CLAIMED IS:

1. A mean preserving interpolation calculation circuit that obtains interpolation data for a missing pixel such that a mean value of a plurality of pixels constituting a group of pixels including the missing pixel is equal to a mean value of a plurality of pixels constituting a group of pixels not including the missing pixel.
2. The mean preserving interpolation calculation circuit of claim 1, wherein the number of pixels constituting the group of pixels including the missing pixel and the number of pixels constituting the group of pixels not including the missing pixel are both  $k$  ( $k$  being a positive integer), the mean preserving interpolation calculation circuit comprising:
  - an incomplete total calculation circuit for obtaining a total of values of the pixels other than the missing pixel in the  $k$  pixels constituting the group of pixels including the missing pixel;
  - a complete total calculation circuit for obtaining a total of values of the  $k$  pixels constituting the group of pixels not including the missing pixel; and
  - a difference circuit for obtaining interpolation data for the missing pixel by subtracting an output of the complete total calculation circuit from an output of the incomplete total calculation circuit.
3. The mean preserving interpolation calculation circuit of claim 2, wherein the complete total calculation circuit comprises:
  - a first complete summing circuit for obtaining a sum of values of  $k$  pixels constituting a first group of pixels not including the missing pixel;

a second complete summing circuit for obtaining a sum of values of  $k$  pixels constituting a second group of pixels not including the missing pixel; and

an averaging circuit for obtaining a mean of an output of the first complete summing circuit and an output of the second complete summing circuit.

4. The mean preserving interpolation calculation circuit of claim 2, wherein

each said group of pixels constitutes a portion of a periodically varying series of pixels, none of the pixels constituting the group of pixels not including the missing pixel are among the pixels constituting the group of pixels including the missing pixel, and said  $k$  is set to a value substantially equal to a period of pixel variation represented by a number of pixels, or to an integer multiple thereof.

5. The mean preserving interpolation calculation circuit of claim 2, wherein

each said group of pixels constitutes a portion of a periodically varying series of pixels,  $i$  pixels ( $i$  being a positive integer) in the pixels constituting the group of pixels not including the missing pixel coincide with  $i$  pixels in the pixels constituting the group of pixels including the missing pixel, and said  $k$  or a value obtained by subtracting said  $i$  from said  $k$  is set to a value substantially equal to a period of pixel variation represented by a number of pixels, or to an integer multiple thereof.

6. A pixel interpolation circuit comprising the mean preserving interpolation calculation circuit of claim 1 and a circuit using maximum and minimum values of pixels in a

neighborhood of the missing pixel to limit the output range.

7. A pixel interpolation circuit comprising a plurality of mean preserving interpolation calculation circuits as recited in claim 2,

wherein the mean preserving interpolation calculation circuits have different values of said  $k$  or  $(k - i)$ ,

further comprising an output circuit,

the plurality of mean preserving interpolation calculation circuits generating respective interpolation data for the missing pixel,

the output circuit selecting one of the interpolation data output by the plurality of mean preserving interpolation calculation circuits and outputting the selected data as the interpolation data for the missing pixel.

8. The pixel interpolation circuit of claim 7, further comprising an adjacent pixel mean interpolation calculation circuit for generating the mean value of pixels adjacent to the missing pixel as interpolation data, wherein

the output circuit selects one of the interpolation data output by the plurality of mean preserving interpolation calculation circuits and the adjacent pixel mean interpolation calculation circuit and outputs the selected data as the interpolation data for the missing pixel.

9. The pixel interpolation circuit of claim 8, further comprising a selection signal generator generating a selection signal for selecting one of the data from the plurality of interpolation calculation circuits based on original data of a pixel in a neighborhood of the missing pixel and interpolation data obtained for the pixel in the

neighborhood of the missing pixel by methods identical to the methods by which the interpolation data for the missing pixel are obtained.

10. The pixel interpolation circuit of claim 9, further comprising:

a control circuit causing

the incomplete total calculation circuit in each of the plurality of mean preserving interpolation calculation circuits to receive pixels, other than a test non-missing pixel in a neighborhood of the missing pixel, in  $k$  pixels constituting a group of pixels including the test non-missing pixel, and obtain a total sum of their values,

the complete total calculation circuit in each of the plurality of mean preserving interpolation calculation circuits to receive  $k$  pixels constituting a group of pixels not including the test non-missing pixel and obtain a sum of their values,

the difference circuit in each of the plurality of mean preserving interpolation calculation circuits to obtain interpolation data for the test non-missing pixel by subtracting an output of the incomplete total calculation circuit from an output of the complete total calculation circuit, and

the adjacent pixel mean interpolation calculation circuit to receive pixels adjacent to a test non-missing pixel disposed in a neighborhood of the missing pixel, the test non-missing pixel being non-adjacent to the missing pixel, and output their mean value as interpolation data for the test non-missing pixel,

wherein,

the selection signal generator evaluates each of the plurality of interpolation calculation circuits, based on the interpolation data obtained by each interpolation

calculation circuit for the test non-missing pixel and original data of the test non-missing pixel, and determines content of the selection signal so as to select the interpolation calculation circuit receiving the best evaluation, and

the control circuit causes the incomplete total calculation circuit in each of the plurality of mean preserving interpolation calculation circuits to receive the pixels constituting the group of pixels including the missing pixel, causes the complete total calculation circuit in each of the plurality of mean preserving interpolation calculation circuits to receive the pixels constituting the group of pixels not including the missing pixel, causes the adjacent pixel mean interpolation calculation circuit to receive the pixels adjacent to the missing pixel, and causes the output circuit to select and output the interpolation data from one of the interpolation calculation circuits according to the selection signal with content determined as above.

11. The pixel interpolation circuit of claim 8, further comprising a selection signal generator generating a selection signal for selecting one of the data from the plurality of mean preserving interpolation calculation circuits based on original data of a pixel in a neighborhood of the missing pixel and interpolation data obtained for the pixel in the neighborhood of the missing pixel by methods identical to the methods by which the interpolation data for the missing pixel are obtained.

12. The pixel interpolation circuit of claim 9, further comprising:

    a control circuit causing  
    the incomplete total calculation circuit in each of the

plurality of mean preserving interpolation calculation circuits to receive pixels, other than a test non-missing pixel in a neighborhood of the missing pixel, in  $k$  pixels constituting a group of pixels including the test non-missing pixel, and obtain a total sum of their values,

the complete total calculation circuit in each of the plurality of mean preserving interpolation calculation circuits to receive  $k$  pixels constituting a group of pixels not including the test non-missing pixel and obtain a sum of their values, and

the difference circuit in each of the plurality of mean preserving interpolation calculation circuits to obtain interpolation data for the test non-missing pixel by subtracting an output of the incomplete total calculation circuit from an output of the complete total calculation circuit,

wherein,

the selection signal generator evaluates each of the plurality of mean preserving interpolation calculation circuits, based on the interpolation data obtained by each mean preserving interpolation calculation circuit for the test non-missing pixel and original data of the test non-missing pixel, and determines content of the selection signal so as to select the mean preserving interpolation calculation circuit receiving the best evaluation, and

the control circuit causes the incomplete total calculation circuit in each of the plurality of mean preserving interpolation calculation circuits to receive the pixels constituting the group of pixels including the missing pixel, causes the complete total calculation circuit in each of the plurality of mean preserving interpolation calculation circuits to receive the pixels constituting the group of pixels not including the missing pixel, and causes the output circuit to select and output the interpolation

data from one of the interpolation calculation circuits according to the selection signal with content determined as above.

13. A mean preserving interpolation calculation method that obtains interpolation data for a missing pixel such that a mean value of a plurality of pixels constituting a group of pixels including the missing pixel is equal to a mean value of a plurality of pixels constituting a group of pixels not including the missing pixel.

14. The mean preserving interpolation calculation method of claim 13, wherein the number of pixels constituting the group of pixels including the missing pixel and the number of pixels constituting the group of pixels not including the missing pixel are both  $k$  ( $k$  being a positive integer), comprising:

an incomplete total calculation step for obtaining a total of values of the pixels other than the missing pixel in the  $k$  pixels constituting the group of pixels including the missing pixel;

a complete total calculation step for obtaining a total of values of the  $k$  pixels constituting the group of pixels not including the missing pixel; and

a difference step for obtaining interpolation data for the missing pixel by subtracting an output of the complete total calculation step from an output of the incomplete total calculation step.

15. The mean preserving interpolation calculation method of claim 13, wherein the complete total calculation step comprises:

a first complete summing step for obtaining a sum of values of  $k$  pixels constituting a first group of pixels not

including the missing pixel;

a second complete summing step for obtaining a sum of values of  $k$  pixels constituting a second group of pixels not including the missing pixel; and

an averaging step for obtaining a mean of an addition result of the first complete summing step and an addition result of the second complete summing step.

16. The mean preserving interpolation calculation method of claim 14, wherein

each said group of pixels constitutes a portion of a periodically varying series of pixels, none of the pixels constituting the group of pixels not including the missing pixel are among the pixels constituting the group of pixels including the missing pixel, and said  $k$  is set to a value substantially equal to a period of pixel variation represented by a number of pixels, or to an integer multiple thereof.

17. The mean preserving interpolation calculation method of claim 14, wherein

each said group of pixels constitutes a portion of a periodically varying series of pixels,  $i$  pixels ( $i$  being a positive integer) in the pixels constituting the group of pixels not including the missing pixel coincide with  $i$  pixels in the pixels constituting the group of pixels including the missing pixel, and said  $k$  or a value obtained by subtracting said  $i$  from said  $k$  is set to a value substantially equal to a period of pixel variation represented by a number of pixels, or to an integer multiple thereof.

18. A pixel interpolation method comprising a further step of using maximum and minimum values of pixels in a

neighborhood of the missing pixel to limit the output range of the interpolation data obtained by the mean preserving interpolation calculation method of claim 13.

19. A pixel interpolation method wherein the mean preserving interpolation calculation step of claim 14 is performed with a plurality of different values of said  $k$  or  $(k - i)$ , each time generating interpolation data for the missing pixel, and

the output step selects one of the interpolation data output by the plurality of mean preserving interpolation calculation steps and outputs the selected data as the interpolation data for the missing pixel.

20. The interpolation method of claim 19, further comprising an adjacent pixel mean interpolation calculation step for generating the mean value of pixels adjacent to the missing pixel as interpolation data, wherein

the output step selects one of the interpolation data output in the plurality of mean preserving interpolation calculation steps and the adjacent pixel mean interpolation calculation step and outputs the selected data as the interpolation data for the missing pixel.